TAX SUPPORTED
LOAD RESTRICTED
BRIDGES

TRENTON - MORRISVILLE
(Calhoun Street)

WASHINGTON CROSSING

NEW HOPE - LAMBERTVILLE

RIEGELSVILLE

EASTON - PHILLIPSBURG
(Northampton Street)

RIVERTON - BELVIDERE

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TRENTON, NEW JERSEY

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# REPORT ON BRIDGE SAFETY INSPECTION

*for*

# DELAWARE RIVER JOINT TOLL BRIDGE COMMISSION

MORRISVILLE, PENNSYLVANIA

DELAWARE RIVER JOINT TOLL BRIDGE COMMISSION
ESTABLISHED
1934
PENNSYLVANIA-NEW JERSEY

*by*

MICHAEL BAKER, JR., INC.
Consulting Engineers
Rochester, Pennsylvania

JUNE, 1970

#24
6/29

## DELAWARE RIVER JOINT TOLL BRIDGE COMMISSION

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MICHAEL BAKER, JR., INC.

THE BAKER ENGINEERS

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ROCHESTER, PENNSYLVANIA - 15074
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June 1, 1970

Delaware River Joint Toll Bridge Commission
Mr. William R. Johnson, Executive Director
Administration Building
Morrisville, Pennsylvania 19067

Subject: Semi-annual Report - Bridge Safety Inspection
Six Tax-Supported - Load-Restricted Bridges

Gentlemen:

We are pleased to present the attached reports on the safety inspection of the six tax-supported, load-restricted bridges owned and operated by the Commission. The Commission has authorized a regular semi-annual inspection of these crossings since the condition of each structure requires a close, regular inspection due to old age and heavy daily use.

The following is a tabulation of the six bridges included with this report:

| | |
|---|---|
| Calhoun Street | Riegelsville |
| Washington Crossing | Belvidere |
| New Hope-Lambertville | Northampton Street |

A thorough physical inspection was made during March 1970 by Mr. Ralph E. King of Michael Baker, Jr., Inc. and Mr. Leslie Eddowes of the Delaware River Joint Toll Bridge Commission. Field notes pertaining to this inspection are on file in the Harrisburg Office of Michael Baker, Jr., Inc.

Maintenance personnel from the Commission staff have made a conscientious effort to correct deficiencies noted during previous semi-annual inspections and should be commended for their work.

The fact remains that these six bridges have nearly reached their practical useful life. This inspection did not reveal any new serious deficiencies that would require a further reduction in load-carrying capacity, although certain repairs are recommended at each bridge.

Based on the inspections and engineering judgment, we consider the six structures safe for the posted loads.

Should you have any questions relative to any part of this report, we will be pleased to meet with you at your convenience to discuss the matter in detail.

Sincerely yours,
MICHAEL BAKER, JR., INC.

Michael Baker, Jr. P.E.

Michael Baker, Jr., P.E.
President

Attachments

# LOCATION MAP

## DELAWARE RIVER JOINT TOLL BRIDGE COMMISSION

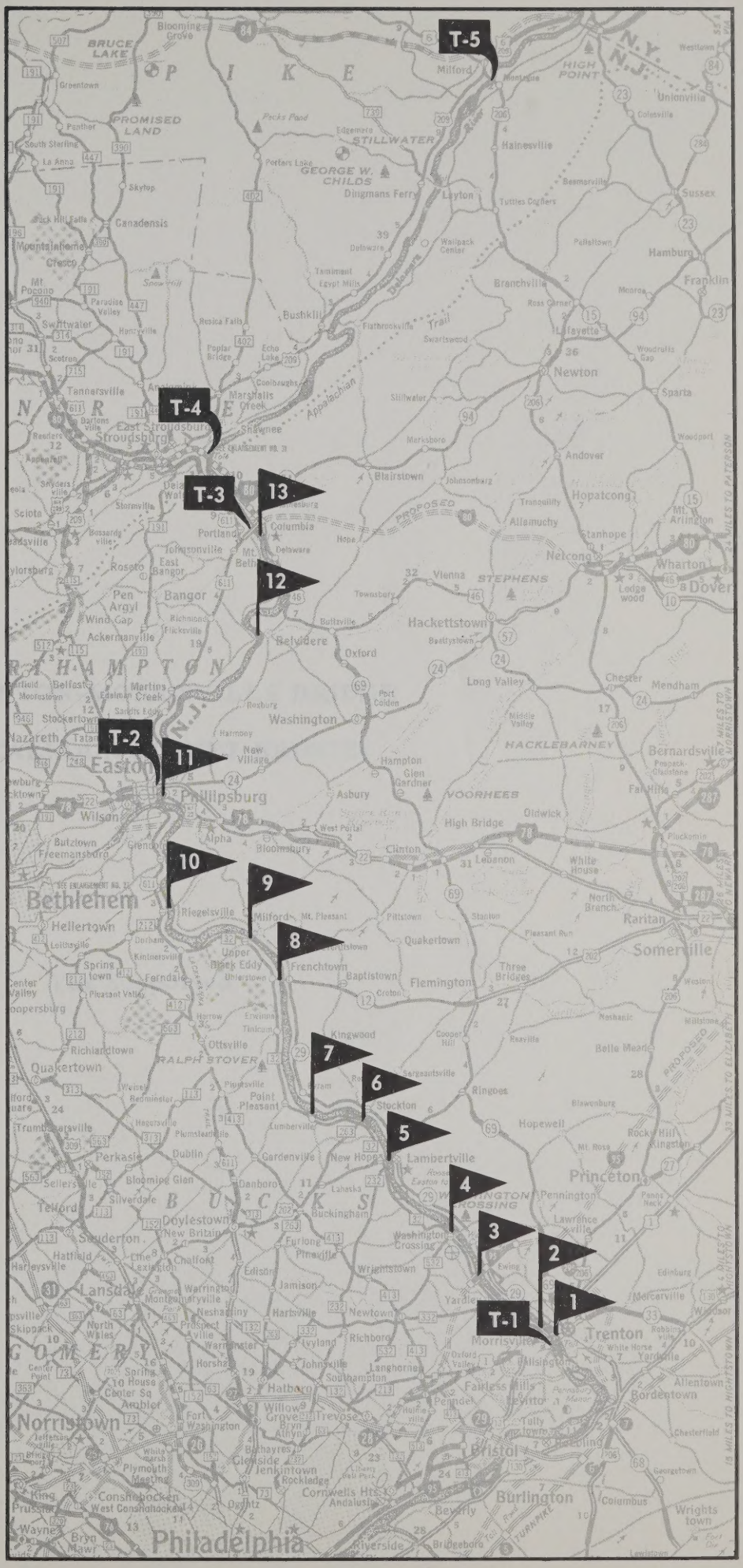
### LEGEND

**TOLL BRIDGES**

T-1 TRENTON - MORRISVILLE
T-2 EASTON - PHILLIPSBURG
T-3 PORTLAND - COLUMBIA
T-4 DELAWARE WATER GAP
T-5 MILFORD - MONTAGUE

**TAX SUPPORTED BRIDGES**

1 TRENTON - MORRISVILLE (Lower Trenton)
2 TRENTON - MORRISVILLE (Calhoun Street)
3 SCUDDER FALLS
4 WASHINGTON CROSSING
5 NEW HOPE - LAMBERTVILLE
6 CENTRE BRIDGE - STOCKTON
7 LUMBERVILLE - RAVEN ROCK (Pedestrian)
8 FRENCHTOWN - UHLERTON
9 UPPER BLACK EDDY - MILFORD
10 RIEGELSVILLE
11 EASTON - PHILLIPSBURG (Northampton Street)
12 RIVERTON - BELVIDERE
13 PORTLAND - COLUMBIA (Pedestrian)



# TRENTON-MORRISVILLE BRIDGE

## (CALHOUN STREET BRIDGE)

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AERIAL VIEW
CALHOUN STREET BRIDGE

Trenton, New Jersey - Upper Foreground
Morrisville, Pennsylvania - Lower Foreground

TRENTON-MORRISVILLE BRIDGE

CALHOUN STREET BRIDGE

Semi-Annual Inspection
March 1970

## GENERAL

The Calhoun Street Bridge over the Delaware River between Morrisville, Pennsylvania and Trenton, New Jersey, is a 7 span wrought-iron truss bridge. The piers and abutments are rubble stone faced built in 1861 for a timber structure. The 7 steel truss spans (180 feet each) were built in 1884. The present 5 inch open steel grid floor was laid in 1949. The clear roadway width is 18 feet and there is a 6 foot wide sidewalk on the upstream side of the bridge.

The superstructure of the bridge is 86 years old. The average daily traffic is over 22,000 vehicles. The bridge is restricted and posted for 6 ton vehicles at a maximum speed of 15 miles per hour.

## FIELD INSPECTION

A thorough inspection of the entire bridge was made in March 1970. The deficiencies are noted under Item C. (Conditions noted during 1970 Inspection)

Conditions noted during the 1968 and 1969 inspections remain approximately the same as previously reported and are restated in this report.

### A. CONDITIONS NOTED DURING 1968 INSPECTION

1. The end posts and upper chord members of the trusses are tubular type members made up of four curved plates riveted together at the corners. The inside walls of the tubular members were never painted. Considering its age, the partially protected inside faces have been very resistant to corrosion. In some areas, the riveted corners were not drawn tight, allowing moisture to enter in the gap. This moisture has contributed to corrosion. As corrosion builds up, the corroded material swells. The pressure from swelling has popped the heads of some of the rivets. With rivets out, plates separate further, allowing more moisture to enter, creating more corrosion on the inside. The inside faces of the tubes cannot be visually examined, however, critical areas were tapped on the outside with a hard steel edge hammer. The difference in sound between a sharp ring and a dull thud will give some indication of the degree of inside corrosion. The inspectors did not detect or note any dull thud areas.

2. The wind bracing connection to the top chord on the downstream side of Panel Point U5 in Span 5 is corroded off.

3. The wind bracing connection to the top chord on upstream truss at Panel Point U4 in Span 6 is seriously corroded.

   Corrosion build-up has popped the heads of two rivets in the wind bracing top chord connection at Panel Point U5 in the upstream truss of Span 6.

4. Corrosion build-up has popped the heads of three rivets at Panel Point U6 in the upstream truss of Span 7.

5. Holes, due to corrosion, were noted in the webs of two stringers at a point 5 feet ± from the New Jersey abutment. There is also a considerable loss in flange areas at the same location. Computations indicate that deficiencies in the stringers, as noted above, are not a controlling factor in the live load maximum rating.

6. At some time in the past, overhead wires were supported on steel frames at the Piers and Abutments. The anchor bolts and lugs are nearly missing due to corrosion. The frames serve no useful purpose and their security is questionable. The frames should be removed.

7. The concrete in the bearing area of the shoe under the downstream truss at Pier 2 is cracking and the reinforcing steel is exposed.

8. The anchor bolts for the fixed shoe under the upstream truss of Span 4 are bent, causing metal breakout of base plate casting.

9. The grout bed under the bearing shoe for the downstream truss of Span 5 at Pier 4 has disintegrated. Apparently the expansion shoe is not functioning properly and the entire shoe assembly is sliding on the disintegrated grout bed. Movement occurs under the passage of every vehicle.

   The roller assembly at the bearing was originally fabricated and assembled with spacing control bars on each end. The control bars have corroded into pieces, thus, no longer functioning to keep rollers in line.

10. Anchor bolts on the downstream truss bearing for the expansion shoe on Pier 5 are loose and worn.

## B. CONDITIONS NOTED DURING 1969 INSPECTION

11. The inside diagonal member U5L6 on the downstream truss of Span No. 5 is loose. The adjoining outside member of the pair is carrying the entire load. With the restricted load, this condition is not serious at the present time.

12. The inside diagonal member L3U4 on the upstream truss of Span No. 7 has been damaged by a vehicle and is loose. The adjoining outside member of the pair is carrying the entire load. With the restricted load, this condition is not serious at the present time.

13. The concrete under Stringer No. 9 on the downstream side of Pier No. 4 has deteriorated and provided a minimum support. The stringer bearing plate is loose and shims are out.

14. The expansion dam between Spans 4 and 5 is loose and noisy. The dam deflects and moves during passage of every vehicle. Failure of the expansion dam is possible at any time in the near future.

15. The areas between the backwall and the floor beams at both abutments are full of dirt contributing to further floor beam deterioration.

16. The treadle adjacent to the New Jersey abutment is worn and loose.

17. Water was standing in the expansion roller nests of several bearing assemblies.

The maximum single truck load permitted to cross the bridge at the present time is 6 tons. A Chart showing this maximum load is posted on the bridge together with speed restrictions of 15 miles per hour. The 6 ton load corresponds to the AASHO design load of H6-S4. 8.

Considering the age and condition of the structure and the type of steel, an allowable stress of 14,000 pounds per square inch has been used in an office analysis to determine the safe load carrying capacity of the bridge. The computed stresses in the critical areas do not exceed 14,000 pounds per square inch for a H6-S4. 8 (6 ton load) roadway and sidewalk load as defined by AASHO Specifications.

A further check was made to determine the stresses in critical members due to passenger car traffic. For this analysis, each lane was assumed to be loaded with cars having an average weight of 4,000 pounds and spaced with one car in each 20 feet of bridge length. The calculated stresses for such a load are approximately equal to a H6-S4.8 AASHO loading. This loading corresponds to and is reflected in the 6 ton maximum load chart.

## C. CONDITIONS NOTED DURING 1970 INSPECTION

1. The bituminous surface course adjacent to the expansion dam at the Pennsylvania abutment has been worn down approximately 1-1/8 inches.

2. The major portion of the slip resistant surface of the grid deck is worn off in the area where wheels ride on the bridge deck. Welds are worn off and deck bars are breaking loose.

3. The flanges and the bottom area of the webs of stringers are rusted and reduced in thickness by approximately 1/8 inch on the following stringers:

| Span | Stringer No's |
|---|---|
| 1 | 2, 4, 5, 6 & 8 |
| 2 | 4, 6 & 8 |
| 3-7 | 2, 4, 6 & 8 |

Note: Spans are numbered starting from the Pennsylvania side and stringers are numbered 1 through 9 starting from the upstream side.

Paint is practically non-existant on the stringers.

4. The grid deck is broken loose from the expansion dam for approximately 3 feet on the upstream and downstream sides at Piers 2 and 6.

5. The expansion dam for Span 4 at Pier No. 3 is 3/8 inch high due to worn bolts not holding the dam in position. This contributed to roughness and noise when traffic passes over the dam.

6. The base plate on the downstream shoe for Span 5 at Pier 4 continues to move. The concrete under the base plate has deteriorated to the extent that approximately 5/8 inch is missing.

7. The concrete is spalling from 3 to 4 inches adjacent to and under the bearing on the upstream Pennsylvania side of Pier No. 4.

8. The concrete continues to deteriorate under the base plate on the downstream side of Pier No. 5, Span No. 6. The span appears to have settled approximately 3/8 inch.

9. The concrete is spalling to a depth of approximately 6 inches on the inside of the upstream bearing at Pier No. 6.

10. The upper portion of the expansion shoe and roller nest was 3-3/4 inches out of normal in an expanded position for both upstream and downstream bearings of Span No. 7 at Pier No. 6 when temperature was 43° F.

11. The following members show signs of having been hit and bent by vehicles:

    Span No. 5 DS Diagonal (U4-L5) Inside Bar
    Span No. 6 DS Diagonal (L5-U6) Inside Bar
    Span No. 6 US Vertical (U1-L1) Inside Bar
    Span No. 7 US Diagonal (L3-U4) Inside Rod
    Span No. 7 US Vertical (L8-U8) Inside Bar

12. The steel frames that originally supported overhead wires are seriously corroded. Their stability is very questionable because of corroded anchor bolts and slip angles. The frames should be removed.

13. There was one sidewalk plank in each of Spans 2 and 5 that was in very poor condition and should be replaced now. Others are approaching a similar condition.

14. The paint on the entire bridge is in poor condition. The top and bottom flanges and the lower half of the webs of the stringers have very little paint and the metal is corroding. There is some flaking and peeling on the truss members.

15. New signs have been erected on Spans 1 and 7. The information on the signs is as follows:

    10' clearance for bottom strut
    Speed limit 25 MPH
    6 Ton Gross
    No trucks or buses

## CONCLUSIONS

The bridge is 86 years old. The average daily traffic is over 22,000 vehicles. The roadway width is only 18 feet. Maximum loads are restricted to 6 tons with a maximum speed of 25 miles per hour.

While the 1970 inspection did not reveal anything that would require a further restriction on maximum loads, it is obvious that the condition of the bridge continues to deteriorate due to age and wear.

Maintenance personnel are keeping the structure in a useable condition, however, due to the overall deteriorated condition and obsolescence, costly repairs and rehabilitation is not recommended.

Ultimately, the bridge must be replaced. Planning is and should continue to be directed in that direction.

# WASHINGTON CROSSING BRIDGE

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WASHINGTON CROSSING TAX SUPPORTED BRIDGE

View from New Jersey Shore

WASHINGTON CROSSING

Semi-Annual Safety Inspection
March 1970

## GENERAL

The bridge at Washington Crossing over the Delaware River is a 6 span (each span 143 feet), double Warren truss bridge built in 1904. The roadway has a clear width of 15 feet, with a 5 inch open grid floor laid in 1951. The 42 inch wide sidewalk on the downstream side was added in 1926.

The bridge is presently posted with a 5 ton maximum loading chart. This limit was reduced from 6 ton to 5 ton in 1968 following the safety inspection at that time.

The general appearance of the bridge is good, however, the material used in the original construction was very thin. Much of the main chord material, including gusset plates, was only 1/4 inch thick when installed.

## FIELD INSPECTION

A thorough inspection of the entire bridge was made in March 1970. During this inspection, certain deficiencies were noted. Some of these can and should be corrected by maintenance personnel. Others cannot be repaired within practical limits and are of a nature that repair is not required for the safety of the structure

The following is a tabulation of deficiencies categorized relative to disposition:

### A. ITEMS THAT ARE TO BE OBSERVED DURING FUTURE INSPECTIONS

1. All deck expansion joints had a clearance of 1-1/8 ± at 34° F., indicating that expansion is working satisfactorily.

2. The grid deck is in good condition

3. The pointing on Piers 1, 2, 3 and 4 is in good condition. Pier 5 is in fair condition.

4. The roller nests at Abutment No. 1 and Pier No. 1 were 2 inches out of normal, in an expanded position, when temperature was 34° F.

   The roller nest at Pier No. 2 was 5/8 inch out of normal in a contracted position.

   The roller nests at Piers 4 and 5 were in a centered position. One roller is missing at Pier 4.

5. Paint is peeling around the lateral connections and red lead point is being exposed.

6. The paint on the upper chords of Spans 1, 2 and 3 is weathering thin.

B. ITEMS THAT SHOULD BE TAKEN CARE OF BY COMMISSION PERSONNEL DURING 1970

1. Stones are being pushed forward and the mortar is loose at the top of the center area of the Pennsylvania abutment. This area should be cleaned and pointed.

2. The mortar is loose and deteriorated in the top course of stone of the New Jersey abutment. These joints should be cleaned and pointed.

3. At Pier No. 5 from the Pennsylvania side, the fingers in the expansion dam are 1/4" to 3/8" out of level. This is partially due to loose and worn bolts at the fixed end of short stringers in Span No. 6. The worn bolts should be replaced with high tensile strength bolts concurrently with adjustment of dam so fingers will line up.

4. Repairs have been made on the lower chord by welding. During these repairs, the paint was overheated beyond the weld area. Rust is beginning to appear. These areas should be cleaned and spot painted.

## CONCLUSIONS

The useful life of the bridge is being prolonged by good maintenance. In order that this be continued, the bridge should be scheduled for an entire painting in 1971 or 1972.

The bridge was posted for a 5 ton load following the "In Depth" inspection and structural analysis in 1968. Based on the previous analysis, recorded observations from the most recent inspection and engineering judgement, we consider the bridge to be safe for 5 ton loads and recommend no change in the present 5 ton rating.

The bridge should be thoroughly inspected and appraised annually under the direction of a qualified engineer. The bridge guards should be directed to inspect the bridge daily and report any irregularities to the Chief Engineer of the Delaware River Joint Toll Bridge Commission.

# NEW HOPE-LAMBERTVILLE BRIDGE

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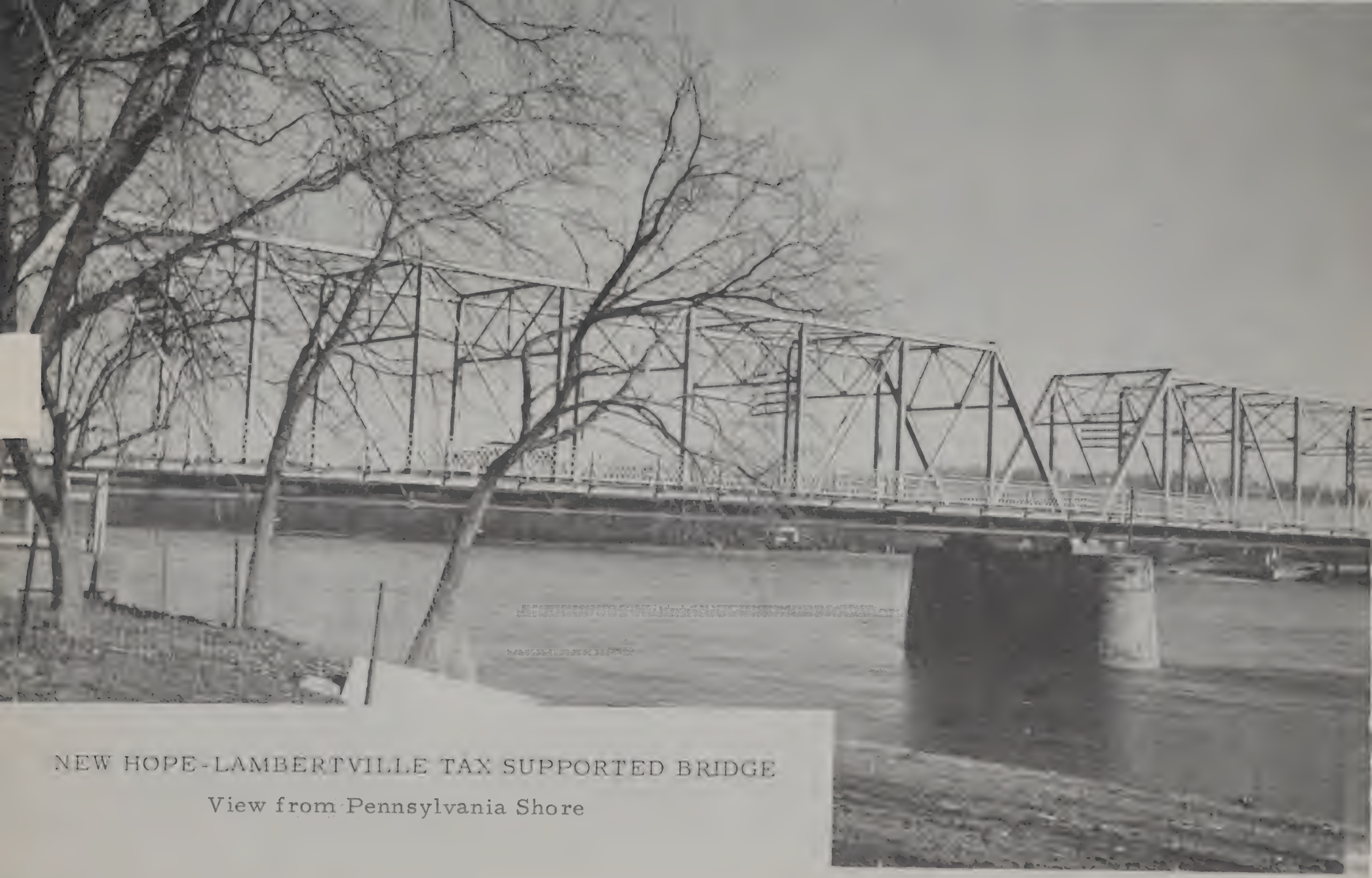

NEW HOPE-LAMBERTVILLE TAX SUPPORTED BRIDGE

View from Pennsylvania Shore

# NEW HOPE-LAMBERTVILLE BRIDGE

Semi-Annual Safety Inspection
March 1970

## GENERAL

The New Hope-Lambertville structure is a 6-span (each span 171 feet) through truss bridge constructed in 1903. The original construction included a wood deck. This was replaced with an open grid steel deck in 1947. Numerous repairs have been made through the years to take care of damage by high water and traffic accidents. Repairs have also been made to correct deficiencies due to loss of section from corrosion.

The bridge is presently limited to a 8 ton maximum vehicle load. This limit was established by the Commission following our inspection in 1968 and reaffirmed in our Inspection Report of September 1969. Prior to 1968, a 12 ton limit was in affect.

As reported in our September 1969 annual inspection report, many of the more serious deficiencies reported in our 1968 Report had been satisfactorily repaired. Likewise, deficiencies noted in our September 1969 Report have been repaired to the extent feasible by Commission Maintenance personnel.

This bridge is 67 years old and is subject to a heavy daily volume of traffic. Maintenance has been good, however, wear due to traffic and normal deterioration due to age has contributed to its present condition.

## FIELD INSPECTION

A thorough inspection of the entire bridge was made in March 1970. During this inspection, certain deficiencies were noted. Some of these can and should be corrected by maintenance personnel. Others cannot be repaired within practical limits and are of a nature that repair is not required for the safety of the structure.

The following is a tabulation of deficiencies categorized relative to disposition:

A. Items noted that are to be checked during future semi-annual inspections.

1. Many members were repaired following the 1968 Inspection. Repairs appear satisfactory, however, these areas could be future trouble spots and should be kept under surveilance. The list of members repaired is tabulated in the inspector's field notes.

2. The concrete sidewalk has eight spalled areas, approximately 10" x 20" in area by 1/2 inch in depth.

3. Two stringers at the expansion dam at the Abutment No. 1 (Pennsylvania side) (Stringers No.'s 4 and 6 numbering upstream to downstream) have holes in the webs adjacent to the deck concrete, due to corrosion. The holes are approximately 6 inches square. The webs of other stringers at this location are reduced in thickness by 1/8" ± due to corrosion.

4. In Span 1, on the downstream side at Panel Point 2, there is a hole (1-1/4" x 5/8") in the web of the inside channel of the vertical L2U2.

5. In Span 2, on the downstream side at Panel Point L8, the web of the outside channel of member L8L9 is reduced in thickness by 1/8 inch adjacent to the pin plate.

6. In Span 3, on the downstream side at Panel Point L1, corrosion adjacent to the pin is reducing the effective area of the channel forming the chord L0-L1. This should be reevaluated for repairs during the next inspection.

7. The vertical angles of the east end portal have a loss of section of approximately 50 percent due to corrosion.

8. The vertical angles of the east end portal of Span 4 have spread 7/8 inch due to corrosion.

9. The inner channel of member U3L3 in Span 4 is showing signs of reduction in area due to corrosion.

10. There is a hole (2" x 1/4") in the web of the outer channel of member L8L9, Span 5.

11. In Span 6, there is rust buildup on the back side of the chord angles of the sway frames. The angles are spread 3/4 inch between stitch rivets.

12. The counter member L3U4 in Span 3 at L3 has developed a hairline crack 1-3/4 inches long on both sides of the bar.

B. Items that should be taken care of by Commission maintenance personnel during 1970.

1. There is some flaking of the paint on the tops of the upper chord truss members. Spot painting would prolong the life of the overall paint job.

2. The expansion dam in the sidewalk area of Abutment No. 1 was jammed when the temperature was 42°F. There is a 3/4 inch open crack between the approach and the sidewalk backwall. This may close when the bridge expands. If it does not, it may be necessary to burn off a portion of the plate.

3. Cleaning and painting of the Abutment No. 1 ends of the stringers will curtail the rust on these members.

4. In Span 1, Panel Point 2, upstream side, a sanitary sewer line has a pop valve which discharges into the river quite frequently. The sewer line has been frozen in the recent past and it has been heated to open the line. During this process, the paint on several bridge members was ruined by the heat from torches used to thaw the sewer line. These burned areas should be cleaned and painted.

5. In Span 6, the insulated coating has been burnt off the electrical wiring and the conduit is loose near the top of the end post. Insulation should be repaired and attachments tightened or replaced.

6. The bottom member of the guard rail along the bridge sidewalk is a 2" x 2-1/2" angle. This angle has broken loose in several places and is protruding out on the sidewalk area. The protruding portions are a hazard and should be put back in place and welded to the vertical members.

7. The grid deck is worn, welds are missing and bars are loose. This is more noticeable in Spans 1, 2 and 6. Periodic inspection and repairs are required.

## Conclusions

The structure was field inspected "in-depth" in 1968 and was office analyzed for load carrying capacity. Due to deterioration, the rating was reduced from 12 tons to 8 tons. We recommend no change in this present 8 ton rating.

When the new New Hope-Lambertville Bridge has been opened to traffic, the existing bridge should be re-examined and appraised. Further reduction in loading may be advisable so as to prolong the life of the structure for use by passenger automobile.

# RIEGELSVILLE BRIDGE

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AERIAL VIEW OF RIEGELSVILLE BRIDGE

Riegelsville, Pennsylvania - Upper Background
Riegelsville, New Jersey - Lower Foreground

# RIEGELSVILLE BRIDGE
Semi-Annual Safety Inspection

March 1970

## GENERAL

The original bridge at this site was wood, and was built in 1835. The piers and abutments were rubble stone faced masonry and concrete, built in 1835 and remodeled for the present bridge in 1904.

The present 3 span, 4 cable suspension bridge with stiffening trusses was built in 1904. The span lengths, starting from the Pennsylvania side are 200, 191 and 286 feet in length. The clear roadway width is 16. The present timber floor was laid in 1967.

The bridge is presently limited to a 2.5 ton maximum vehicle load. This limit was established by the Commission following our inspection in 1968 and reaffirmed in our Inspection Report of 1969. Prior to 1968, a 10 ton limit was in affect.

As reported in our September 1969 Annual Report, many of the more serious deficiencies reported in our September 1969 Report have been repaired to the extent feasible by Commission Maintenance personnel.

This bridge is 66 years old. Maintenance has been good during latter years, however, heavy loads in the past together with normal deterioration due to age have contributed to its present condition.

## FIELD INSPECTION

A thorough inspection of the entire bridge was made in March 1970. During this inspection, certain deficiencies were noted. Some of these can be corrected by Maintenance Personnel. Others cannot be repaired within practical limits and/or may be of the nature that repair is not required at the present time for the safety of the structure.

The following is a tabulation of deficiencies categorized relative to disposition:

A. Items noted that are to be rechecked during future inspections:

1. Extensive repairs have been made in accordance with recommendations in our 1968 and 1969 reports. No new failures of these repairs were noted, however, a fracture was noted in the base plate under the cable saddle on the upstream leg of the tower of Pier No. 2. The crack appeared rusty and no movement was observed.

Heavy vehicle loads prior to the 2.5 ton restriction apparently contributed to the failure of certain areas in the towers. Repairs prior to the 2.5 ton load restriction had been ineffective. Repairs following the 2.5 ton load restriction were reported effective during this inspection.

2. In previous inspection reports, it was noted that many I-bars were cracked over the floor beam pins. Those which have been repaired are tabulated in the inspectors field notes. Those listed below have similar small hairline cracks developing in the end forgings:

| Span | Fl BM No. | Side of FB | Side of BR |
|---|---|---|---|
| 1 | 15 | NJ | DS |
| 1 | 38 | PA | DS |
| 1 | 5 | NJ | US |
| 1 | 8 | NJ | US |
| 1 | 34 | PA | US |
| 2 | 2 | NJ | DS |
| 3 | 29 | NJ | US |

3. On the DS side of the bridge under the sidewalk, the floor beams have a 2" x 6" wood beam between their channels. This beam extends beyond the sidewalk and helps support a water line. The wood adjacent to the steel is accelerating the deterioration of the steel channels by holding moisture. The backs of the channels are being reduced, however, it was impossible to measure how much with the wood beams in place. Eventually, as the wood beams rot, they should be removed and replaced with a steel angle welded to the channels.

4. The following floor beam hanger rods have been hit by vehicles and are bent:

| | | |
|---|---|---|
| Span 1 | US side | Fl. beam 31 & 38 |
| Span 3 | DS side | Fl. beam 1 & 4 |

5. The suspension cables are anchored to I-bars which in turn are anchored into concrete. At all four anchors the I-bars are deteriorated and rust has built up adjacent to the concrete.

B. Items recommended to be taken care of by Commission maintenance personnel during 1970.

1. Clean and paint ends of cable anchor bars at the junction with the concrete abutments.

2. Repair hairline cracks in I-bars listed under A-2.

3. The vertical legs of the bottom chord angles on the trusses between all towers are rusted off approximately 25 inches from the towers on the upstream and downstream sides. This should be repaired by welding a flat bar across the missing section of the vertical leg of the angle.

Conclusions

Maintenance since the 1968 "In-Depth" inspection has been good. While it is not practical to increase the load carrying capacity of the structure, the inspection did not reveal any deficiencies that would place a further restriction on the bridge.

The structure is considered safe for 2-1/2 ton loads, however, the bridge should be inspected daily by the officer on duty. Anything of unusual appearance or action should be reported to the Chief Engineer of the Delaware River Joint Toll Bridge Commission.

EASTON-PHILLIPSBURG BRIDGE

(NORTHAMPTON STREET BRIDGE)

Tax Supported

NORTHAMPTON STREET TAX SUPPORTED BRIDGE

View from Easton, Pennsylvania looking
toward Phillipsburg, New Jersey

NORTHAMPTON STREET BRIDGE
EASTON - PHILLIPSBURG

Semi-Annual Safety Inspection
March 1970

## GENERAL

The Northampton Street Bridge spanning the Delaware River between Easton, Pennsylvania and Phillipsburg, New Jersey is a 3 span, pin connected cantilever truss. The bridge was constructed in 1894-95. General repairs were made in 1925 and 1936. The center span and the cantilever arms were seriously damaged by high water in the 1955 flood. Major repairs were made and the bridge was reopened to traffic in 1957.

The span lengths are 125 feet, 300 feet and 125 feet. The clear roadway width is 40 feet and there are 7 foot wide sidewalks on both sides.

The bridge is posted for a maximum vehicle load of 7 tons and a speed limit of 25 miles per hour.

## FIELD INSPECTION

A thorough field inspection of the entire bridge was made in 1968, 1969 and again in March 1970. The conditions reported in the 1968 Inspection Report are still applicable and are restated in this report, followed by the March 1970 on site observations.

### A. CONDITIONS REPORTED IN 1968 INSPECTION

1. The floor beam stringer system at the Pennsylvania end of the bridge was originally supported on and anchored into the concrete abutment. The concrete under the first stringer from the downstream side of the bridge has deteriorated to the extent that anchor bolts are exposed for their full depth. The superimposed load is being transmitted outside of the original planned bearing area. The deteriorated concrete should be removed and the entire area cut back to form a good joint for the new concrete. Due to the deteriorated condition of the concrete, water ponds on the top of the abutment and seeps into the mortar joints between the stone masonry walls. Frost action will tend to dislodge the stone. The top of the abutment should be cleaned and grouted on slope for drainage. Conditions are similar in the same area on the New Jersey side, to a lesser degree of deterioration.

2. The anchor bolts at the same points as noted under Item 1, are seriously corroded. These anchor bolts should be replaced after cleaning and further exposure during removal of deteriorated concrete, the assembly should be patch welded.

3. The curb stringers at both abutments rest on I beam supports embedded in concrete. The bottom flanges and webs are practically gone due to corrosion. These supports should be replaced with a new concrete pedestal.

4. The bottom flange of the third stringer from the upstream side of the bridge at the Pennsylvania abutment is corroded to the extent that the flange on one side of the web is completely gone and the other side is paper thin. The missing material is in an area where it does not affect the load carrying capacity of the structure.

5. Corrosion has produced a hole, approximately three-quarter of an inch in diameter in the vertical post member on the downstream, Pennsylvania side of Span No. 1 at Pier No. 1. The material is corroded paper thin for an area spproximately three inches outside of the hole. The location of the corroded area does not affect the load carrying capacity of the bridge.

6. The steel tower portion of the truss over Pier No. 1 includes a system of cross-bracing for lateral support. The cross bracing consists of a top and lower strut with two cross frames, in the shape of a double X. The angles at the center of the X for the downstream half of the cross frame are corroded to the extent that there are holes through the main material.

   The angles forming the top strut in the center at the juncture of the double X are seriously corroded, varying from portions missing to paper thin.

   The double X, with top and bottom cross struts, is the structural system which provides restraint to the towers to resist lateral loads due to wind. The bracing is also a column stiffening system for the legs of the tower. The cross bracing system is a necessary part of the bridge, however, it is secondary in nature. Conditions are not critical at the present time and may be postponed until the next overall paint job.

7. The entire truss is pin connected. The overlapping area between the eye bars and post members is open as far as moisture and corrosion are concerned. The area cannot be thoroughly cleaned or maintained. A considerable amount of corrosion was noted in the area of the pin at the panel point on the upstream side ff the truss at Pier No. 2. After chipping the rust build-up off, it was noted that the one and one-fourth inch bar was reduced in thickness to one inch at the edge. The loss of thickness, being one-fourth inch at the edge but was not measurable toward the pin due to the close fit of the various members.

A similar condition was noted at the first panel point from Pier No. 2 toward the New Jersey side of the bridge. As noted above, the entire bridge is pin connected with a pin serving to join several members together at each panel point. All of the points have close fitting material and are subject to corrosion similar to that for the two panel points mentioned above. Fortunately, the original material had a high degree of resistance to corrosion.

A loss of section was noted and naturally it does affect the load carrying capacity of the bridge. The percentage loss at the present time is small, however, the points should be carefully examined during future inspections.

B. CONDITION REPORTED IN 1969 INSPECTION

8. The hanger rods for the support of the lower lateral bracing are broken in Panels 4 and 5 of Span 1 and in Panel 1 in Span 2. These rods should be repaired or replaced.

C. CONDITIONS NOTED DURING 1970 INSPECTION

1. Water is by-passing scuppers and going through expansion dams at Abutment 1 (Pennsylvania side) on the downstream side of the bridge and at Abutment 2 on both sides of the bridge. The blacktop is worn approximately 1" in traffic lanes and the water by-passes the scuppers through these depressions.

2. The concrete upon which the curb stringers bear at Abutment 2 has deteriorated and fallen away, leaving no support for the stringers. Generally, the concrete at Abutment 2 is spalling and is covered with 6" dirt, which should be cleaned off. Also, there is a 5/8" crack opening between the backwall and approach on the upstream sidewalk.

3. The deck on the bridge is in poor condition. Water is seeping through the deck causing the stringers and floor beam to rust. Paint is deteriorating rapidly. The checkered plates between the sidewalks and curb have been reduced 1/8" due to rust. On the downstream side, the checkered plate has rusted thin (1-1/2" round holes). In Span 2 (PP3) upstream side, water is draining on the curb stringer between deck and buckled plate and rust is building up on the stringer. Also, the stay-in-place forms have rusted through on the upstream side, PP7, 8, 9 and 10 under the sidewalk and downstream side at PP8, 9 and 10.

4. The hanger rods at the center points in the horizontal sway bracing are missing in PP4 and 5 of Span 1 and in PP1, Span 2.

5. The deck expansion had a minimum cleanance of 1-7/8" at 44° and appeared to be working satisfactorily.

6. Span 3 vibrates when loaded. Also, Tower No. 1 sways when bridge is loaded.

7. There is some rust buildup starting to show on the hold-down anchorages near the base area in the pits.

8. The ornaments on the top horizontal struts at Towers 1 and 2 are bolted to the horizontal legs of the top angles with clip angles. The horizontal legs are rusted away under the ornament and the lacing bars are bowed out 3/8". Also many of the lacing bars are corroded and some are missing.

9. The diagonal on the downstream side of Tower No. 1 has corroded to the extent that nearly 75% of one angle is missing.

## CONCLUSIONS

The bridge has been in service for over 72 years and has served very well. Much of the main truss original material was of a type having good resistance to corrosion. The material makeup of the cross bracing for the towers was of thin shapes and not as corrosion resistant as the main truss material. The end floor beam and stringer system has been subjected to chemicals from deck drainage. This, together with difficult to maintain areas, has contributed to the corroded condition.

The general maintenance has been good; however, there are places, such as tight areas around the pins, that are impossible to maintain. Those may be the life-controlling features of the bridge.

The bridge is considered safe for the present 7-ton restricted loading and no change is recommended. Items underscored in this report should be repaired during 1970.

# RIVERTON-BELVIDERE BRIDGE

Tax Supported

RIVERTON - BELVIDERE TAX SUPPORTED BRIDGE
Riverton, Pennsylvania - Left Foreground
Belvidere, New Jersey - Across River

Insert shows view from Pennsylvania Shore.

# RIVERTON-BELVIDERE BRIDGE

Semi-Annual Inspection
March 1970

## GENERAL

The Riverton-Belvidere Bridge over the Delaware River is a 4 span double Warren truss bridge constructed in 1904. The piers and abutments are rough ashler faced masonry and were built in 1836.

The overall length of the bridge is 653 feet with the following spans, starting from the Pennsylvania side:

| | |
|---|---|
| Span No. 1 | 153'-2" |
| Span No. 2 | 153'-2" |
| Span No. 3 | 153'-2" |
| Span No. 4 | 169'-2" |

The roadway deck is 5 inch open grid type steel flooring and there is a clear roadway width of 16 feet. The sidewalk on the upstream side of the bridge is a concrete filled steel grid and is 3.6 feet wide.

The bridge is presently posted for a 8 ton maximum vehicle load and a speed limit of 20 miles per hour.

## FIELD INSPECTION

A thorough inspection of the entire bridge was made in March 1970. The following was reported from this inspection:

1. There is some spalling of the sidewalk concrete from frost at the following locations:

| | |
|---|---|
| Span #1 | PP1 |
| Span #2 | PP1 |
| Span #4 | PP9 |

2. The concrete adjacent to the expansion dam is approximately 5/8" too high at the Pennsylvania approach to the bridge.

3. Abutment No. 1 (Pennsylvania side) has loose mortar in the first and second joints. Piers 1, 2 and 3 and abutment 2 are in good condition.

4. The clearances at the expansion dams in the deck and sidewalks were 1" $\pm$ at 34° F. except for the sidewalk clearance in Span #1 Pennsylvania abutment which is only 1/2". It is possible that this sidewalk plate will jam at a higher temperature.

5. In Span 3, US side at PP2 there is approximately 5" of concrete in the lower chord. A ready mix truck appears to have been washed out in this area.

6. The grid deck is in good condition.

7. The paint is peeling on the tops of the upper chords and sway frames in all spans and red lead is showing. The paint on the lower chord members is in fair condition.

## RECOMMENDATIONS

1. Concrete should be removed from the lower chord at PP2 Span 3 where it was dumped.

2. The sidewalk plate at Abutment No. 1 should be cut back 1" with cutting torch so expansion will not be hindered.

## CONCLUSION

The structure has been well maintained and is in good condition. The bridge is posted for 8 ton vehicles and is safe for these loads. It is recommended that this restricted loading be retained.

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